THE EFFECT OF MOTORIZATION TO THE DEVELOPMENT OF URBAN PUBLIC TRANSPORT

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Abstract

The aim of this study is to explore the effect of motorization to the development of urban public transportation in urban areas in Indonesian city in the last decade. The study employs many statistical data regarding motorization and urban public transport. It can be concluded that the motorization will continue to grow, and the existing transport policy should be re-questioned. It roots on the lack of acceptable provision of public transport in term of quality and quantity, but also as a result of high preference on using private transport. The challenge becomes excessive and complex, since there is no appropriate visionary road map for development of urban public transport. In answering this problem, the authors propose an abstract of two sequence approach, namely setting priority in taking side in provision of acceptable mobility for all, and followed with the redefinition of urban transport development by implementing transit-oriented development.

Key words: motorization, urban public transport, development, sustainability.

INTRODUCTION

The urban population in Indonesian cities has significantly increased from 22.3 % in 1980 to 42 % in 2000 (Dikun, 2003), and it is estimated that will reach 50% - 60% of the population by year 2020. The trend of this rapid urbanization is caused by the lack of job opportunities and the proper public infrastructures outside the major cities. Unfortunately, many major cities' infrastructures and resources could not keep up with its rapid growth. And as a result, the quality of live and the urban structures of the cities are degrading rapidly.

In line with the population growth, the economic development of Indonesian cities shows a rapid growth (e.g. BPS, 2004; the ASEAN Secretariat, 2003). This prosperity's figure leads to increment in car ownership. A plot of cars per capita and wealth (GNP per capita) for twenty-six world cities across five continents found a very strong positive correlation (Dimitriou, 1990). As an example, the motor vehicle per thousand populations in Surabaya has increased 455% from 70 in 1976 become 319 in 1998 (GTZ, 2000). In Jakarta, average number of cars owned per 100 households is 20.7 and average number of cars owned per car-owning household is 1.2 (JICA-Bappenas, 2001).

Beside the growth of population and economic prosperity, the automobile's growth in urban areas is influenced by many factors (see Cervero, 1998 for more discussions). Indeed, it is evidence that motorization is transforming cities and even rural areas of many urban areas in the world and the economic and social benefits are enormous. It provides individual flexible transportation in urban areas and reduced manual labor and improved market access in rural areas, which is heavily needed by developing countries (Sperling and Clausen, 2002). Thus, Cervero (1998) claimed that motorization is a sign of prosperity. Pace of motorization is important because related systems, such as transportation facility capacity and urban structure adjustments cannot keep up, resulting in enormous congestion (Gakenheimer, 1999). In the longer term, however, motorization may stifle local development, increase pollution, and create unprecedented safety hazards (Sperling and Clausen, 2002).

Indeed, the influences of motorization and urbanization, which latter followed by sub-urbanization in many metropolitan areas, have been an interest of transportation and urban researchers for last few decades (for example, see Cervero, 1986; Roberts, 1986; van Beek et al., 1986; Kitamura et al., 2003; Susilo and Kitamura, 2006, among others). However, most of studies were based on evidences in developed countries. It is unclear whether the conclusions based on developed countries are also valid in developing countries, since the transportation conditions of both sides are different in many fundamental ways.

This situation challenges the authors to explore the influence of motorization to the development of public transportation. Thus, this article has an aim to explore the effect of motorization to the development of urban public transport in Indonesia. This article explores statistical data regarding motorization and public transportation to finally propose an approach of improvement. In the following sections, the description concerning motorization and its effects is provided in section two. The development of public transportation in Indonesia' urban area is described in section three. Finally, we discuss and conclude this study in the last section.

MOTORIZATION AND ITS EFFECTS

Trend in Motorization

As in many developing countries, most of the travel activities depend on land transportation. The road length by level of government responsibility and by type of surface in Indonesia is shown in Figure 1~~Figure 1~~ and Figure 2~~Figure 2~~, respectively. Regarding the development of toll road, from 1978, the development of toll road in Indonesia was growing from 46 km to 515.17 km in 1999 (PT. Jasa Marga, 2006). The average daily traffic of toll road are shown in Figure 3~~Figure 3~~.

The growth of motorization in Indonesia is shown in Figure 4~~Figure 4~~, which clearly shows that the motorcycle experiences the highest increase. The other important land transportation is rail transport, as can be seen in Figure 5~~Figure 5~~. At present, rail transport experienced a very hard competition with air transport as the airfare becomes cheaper (Kompas, 2003).

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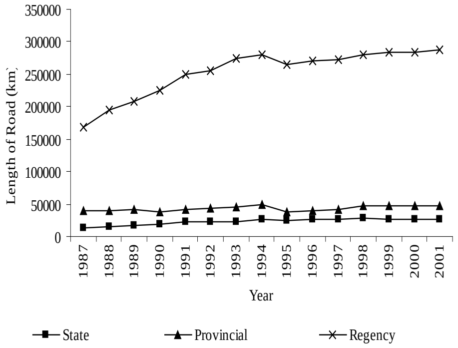

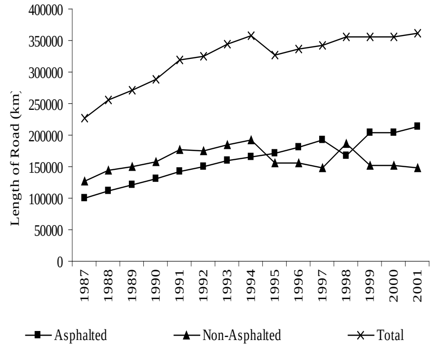

Figure 1 Road Length by Level of Government Responsibility (BPS, 2004)

Figure 2 Road Length by Type of Surface (BPS, 2004)

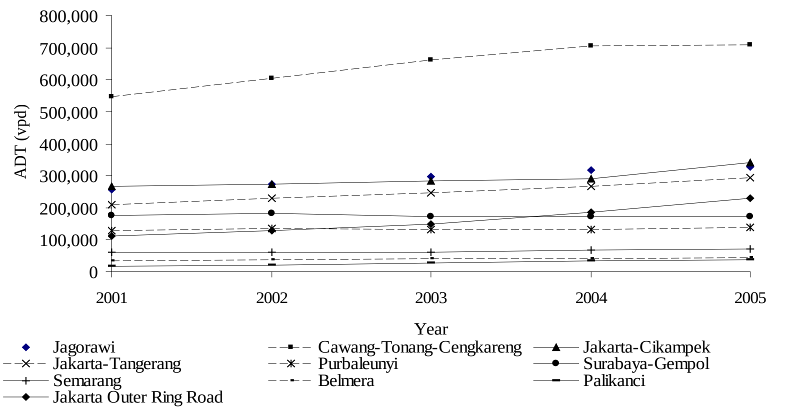

Figure 3 Average Daily Traffic for All Toll Road Branches (PT. Jasa Marga, 2006)

Comparison with Other Countries

To explore the effect of motorization, it is useful to show several qualitative data regarding motorization. Since the scarcity and difficulty to collect the data from all urban areas in Indonesia, this article relies on two cities (i.e. Jakarta and Surabaya), as only those two cities were available in Newman and Kenworthy (1999). The authors attempt to understand the costs of motorization in Indonesia's urban areas to figure out the effect of motorization to the development of public transit.

Firstly, the discussion is about the transportation energy use per capita, as a barometer of the degree of automobile dependence (see Table 1~~Table 1~~). These data include both gasoline and diesel fuel used in private urban passenger, non-passenger transportation, and public transportation. Per capita transportation energy use in Jakarta is 9.1 GJ (gigajoules) and 5.6 GJ in Surabaya. The parameter of transportation energy use per unit of wealth (MJ per dollar of GRP) is an attempt to bring together the environmental and economic aspects of energy use. Gross regional product (GRP) is the measure of all goods and services produced in the regional urban area of the particularly city noted (Newman

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and Kenworthy, 1999). Jakarta consumes 6.02 MJ of transportation energy for every dollar of wealth they generate, while Surabaya consumes 7.73 MJ/$. These values are much higher than wealthier countries, even higher than Asian countries on average. Jakarta and Surabaya appear to have a bigger impact on the local economy than in wealthier countries. Factors that can explain the variations in transportation energy use are technology, economics, infrastructure, and urban forms (Newman and Kenworthy, 1999). Table 1~~Table 1~~ also explains type of fuel, which gasoline is by far the biggest contributor to transportation energy use. In contrast, where cities become more public transportation-oriented, diesel and electricity become much more significant (Newman and Kenworthy, 1999). Jakarta and Surabaya are shown as more automobile-oriented, where higher percentage of energy is used by private transportation.

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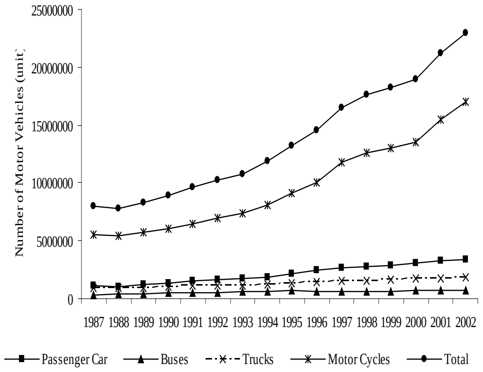

Figure 4 Number of Motor Vehicle by Type in Indonesia (BPS, 2004)

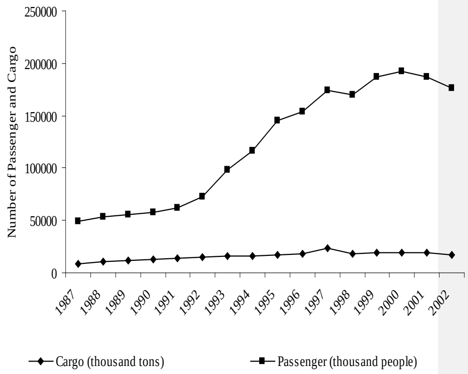

Figure 5 Number of Passengers and Cargo by Rail Transport in Indonesia (BPS, 2004)

Table 1 Transportation Energy Use per Capita in Global Cities, 1990 (Newman and Kenworthy, 1999)

City	Private Transportation			Public Transportation			Total Transportation Energy (MJ)	Total Transportation Energy/$ of GRP (MJ/$)
	Gasoline (MJ)	Diesel (MJ)	% Private of total	Diesel (MJ)	Electricity (MJ)	% Public of total		
American Avg.	55,807	7,764	99	650	129	1	64,351	2.38
Australian Avg.	33,562	4,970	98	764	159	2	39,456	1.96
Canadian Avg.	30,893	6,538	97	1,057	163	3	39,173	?
European Avg.	17,218	7,216	95	604	653	5	25,692	0.83
Asian Avg.	6,311	5,202	89	1,202	148	11	12,862	3.81
Jakarta	4,787	3,845	95	440	0	5	9,072	6.02
Surabaya	2,633	2,684	95	294	0	5	5,611	7.73

Note: the cities for which no energy per unit of GRP is available are those cities not included in the study for the World Bank and that therefore do not have the GRP data.

Related with energy used, it is useful to discuss automobile emissions, as can be seen in Table 2~~Table 2~~. Based on the 1999's data, Jakarta and Surabaya have a similar condition. The emissions in both cities are below the wealthier countries, except the amount of VP that it is much higher comparable with Toronto.

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Table 2 Data about Emission from the Thirty-Seven Cities (Newman and Kenworthy, 1999)

	American Avg.	Australian Avg.	Toronto (Metro)	European Avg.	Wealthy Asian Avg.	Develo-ping Asian Avg.	Jakarta	Surabaya
Total CO_2 per capita (kg)	4541.2	2788.9	2434.3	1887.9	1158.4	836.5	653.2	404.0
NO_x per capita (kg)	22.3	21.9	27.0	13.0	6.2	8.7	16.2	3.1
SO_2 per capita (kg)	1.6	0.6	2.3	2.0	1.3	1.3	0.9	0.9
CO per capita (kg)	204.5	185.8	160.6	72.6	19.8	61.8	57.7	42.0
VHC per capita (kg)	22.3	23.0	21.7	11.6	2.2	13.6	9.3	11.7
VP per capita (kg)	1.0	1.4	3.9	0.8	1.1	3.4	3.4	4.3

Note: VHC = volatile hydrocarbon, VP = volatile particulates

Table 3 Relative Performance and Provision of Transportation Modes in Global Cities, 1990
(Newman and Kenworthy, 1999)

		American Avg.	Australian Avg.	Canadian Avg.	European Avg.	Asian Avg.	Jakarta	Surabaya
% of total pax. km on transit		3.1	7.7	10.2	22.6	48.7	46.1	26.1
% of total pax. km on rail modes		32.0	41.2	25.9	77.3	24.0	2.9	0.0
% work trips on transit		9.0	14.5	19.7	38.8	45.1	36.3	21.0
% work trips by walking and cycling		4.6	5.1	6.2	18.4	19.0	22.3	23.5
Transit service level (veh. km of service per person)		28.4	60.0	58.0	92.5	110.2	54.5	62.2
Road supply (meters per person)		6.9	8.3	4.7	2.4	1.1	0.5	0.3
CBD car parking (spaces per 1000 CBD jobs)		468	489	408	230	144	?	?
Average speeds of travel by mode (kph)	Car	51.1	45.5	39.8	35.9	25.0	23.6	27.0
	Train	37.2	35.0	33.3	41.1	38.1	35.6	-
	Bus	22.0	25.0	21.1	20.9	15.3	14.6	17.5

Notes: 1. Train speeds include heavy rail, light rail, and trams, weighted by passenger kilometers per capita for each mode.
2. The percentage of total transit passenger kilometers on rail includes heavy rail, light rail, and trams.

Table 4 Annual Travel by Private and Public Transportation in Global Cities, 1990
(Newman and Kenworthy, 1999)

City	Annual Travel in Private Cars (pax. km per capita)	Annual Travel in Public Transportation (pax. km per capita)	Total Annual Travel (pax. km per capita)
American Avg.	16,045	474	16,519
Australian Avg.	10,797	882	11,679
Canadian Avg.	9,290	998	10.288
European Avg.	6,601	1,895	8,496
Asian Avg.	2,772	2,587	5,359
Jakarta	1,546	1,323	2,869
Surabaya	1,568	555	2,123

Discussing motorization has a tight relation with the variation of service of other mode of transport. Table 3~~Table 3~~ and Table 4~~Table 4~~ present some values of performance

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and provision of transport mode. The percentage of total motorized passenger kilometers of travels on transit in Jakarta and Surabaya is higher when it is compared with other regions, but the percentage is much lower for percentage on rail mode. The work related trips in Jakarta and Surabaya was dominated by private transport, which amounted to 41% and 55%, respectively. The trend in Jakarta is continuing up to present time as shown in

Figure ***6***

~~Figure *6*~~, which the used of private transport becomes more significant in high income category. The domination of private transport in the total annual travel per capita took place in all regions, as provided in Table 4~~Table 4~~. However, as appears in Table 3~~Table 3~~, it is important to notice the fact that the Asian countries, including Jakarta and Surabaya, have smaller supply of road infrastructure and parking space. This fact explains the critical situation of Indonesia's urban traffic, which is burdened by high preference in using private transport, since transit is not able to give high incentive for car users to change to transit. Transit speed is relatively smaller than car, except train and BRT (which the first corridor was operated in January 15, 2004).

It is also interesting to note, as can be seen in Table 3~~Table 3~~, the using of non-motorized transportation in Jakarta and Surabaya for work related trips is higher than American, Australian, and Canadian cities, and almost similar with European's experience. At present, the using of non-motorized is dominated by low income category.

Land use has a close relation with motorization. Indonesia's cities (i.e. metropolitan, CBD, inner and outer cities) have higher population density than developed cities, including higher jobs density as well (see For many years there has been an implicit assumption among transportation planner, engineers, and economists that there is a close link between mobility and wealth, but mobility is not necessarily related to wealth (Newman & Kenworthy, 1999). Table 6 shows that there is no obvious pattern to the data. By comparing wealthy and developing Asian cities, the poorer cities have 108 percent as much car use in wealthier Asian cities but have an average GRP that is only 12 percent of that in the wealthy Asian cities (Newman & Kenworthy, 1999).

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~~***Table 5***~~). Contrast to developed cities, Indonesia's metropolitan and CBD is not adequately supported by transit system, which makes the city highly dependent on private transport.

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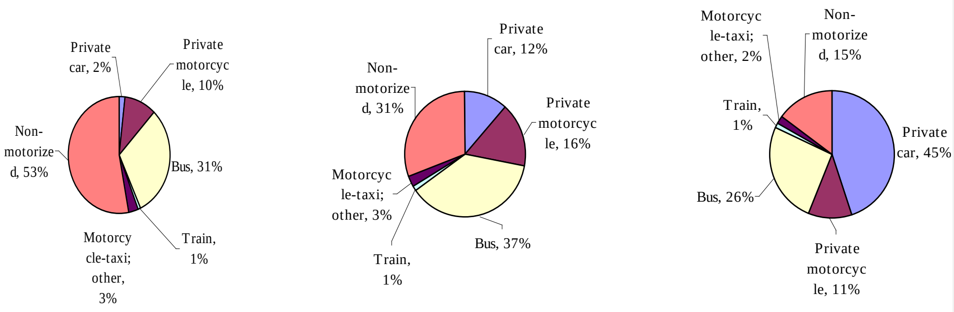

(a) (b) (c)

Figure 6 Modal Split for Each of Three General Income Groups in Jakarta Urban Region:
(a) Low Income, (b) Middle Income, and (c) High Income (PCI and Almec Corp., 2003; Ernst, 2005)

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Table 5 Intensity of Land Use in Global Cities, 1990 (Newman and Kenworthy, 1999)

City	Metropolitan Density		CBD Density		Inner-Area Density		Outer-Area (suburb) Density	
	Pop.	Jobs	Pop.	Jobs	Pop.	Jobs	Pop.	Jobs
American Avg.	14.2	8.1	50.0	429.9	35.6	27.2	11.8	6.2
Australian Avg.	12.2	5.3	14.0	363.6	21.7	26.2	11.6	3.6
Canadian Avg.	28.5	14.4	37.9	354.6	43.6	44.6	25.9	9.6
European Avg.	49.9	31.5	77.5	345.1	86.9	84.5	39.3	16.6
Asian Avg.	161.9	72.6	216.8	480.1	291.2	203.5	133.3	43.5
Jakarta	170.8	58.8	235.1	203.5	266.7	135.2	138.0	32.6
Surabaya	176.9	77.9	360.2	355.6	265.1	?	144.9	?

Table 6 Car Use and Gross Regional Product per Capita, 1990
(Newman and Kenworthy, 1999)

City	Car user per capita (km)	GRP per capita ($US, 1990)
American Average	10,870	26,822
Australian Average	6,536	19,761
Canadian (Toronto, Metro)	5,019	22,572
European Average	4,519	31,721
Wealthy Asian Average	1,487	21,331

Developing Asian Average	1,611	2,642
Jakarta	1,112	1,508
Surabaya	1,064	726

DEVELOPMENT OF URBAN PUBLIC TRANSPORT

Indonesia's urban areas have many types of public transport, which ranges from traditionally human or animal powered up to automatically operated vehicle (likes monorail which is still in construction phase at present). It provides the users with a wide range of mode choice to travel. However, this high variation also gives difficulties to manage and regulate the system. For example, high variety of travel mode in the road results some traffic problems as the operation characteristics for each mode is different. In addition, the progress of the evolution of public transport in Indonesia's urban areas is very slow. The rapid progress takes place only in Jakarta, while in other urban areas the progress seems not substantial, except in the term of quantity but not in line with the progress of quality.

The most threatened mode of transport is non-motorized transport, which its characteristics have been discussed by some researchers (e.g. Joewono and Kubota, 2005a). This mode day by day is going to edge, since they cannot compete with private car or other mode of public transport. This mode is potential as one of the mode for sustainable city, but the fact shows the contrary, where it becomes difficult to find or to use.

The other mode is paratransit (*Angkutan Kota*). The number of paratransit in several provinces in Indonesia from 1990 to 2003 is shown in Figure 7~~Figure 7~~. Some data are provided by BPS (1990-2003) and some of them are available in the city's website. The figure explains the domination in number of this mode in many cities (see e.g. Joewono and Kubota, 2005a; DepKimPrasWil, 2002). On one hand, this mode is twisted by many problems (i.e. financial, institutional, among others) and well known as not able to provide high quality service. On the other hand, the user and community still have a preference and loyalty to use this mode, even in the future (see e.g. Joewono and Kubota, 2005b; 2006). As a private public transport, this mode needs careful examinations to decide its future.

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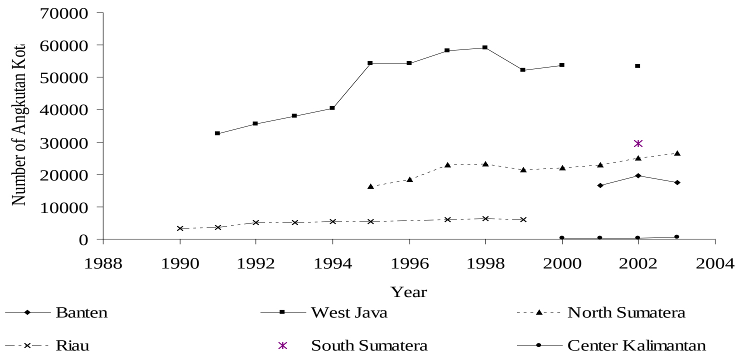

Figure 7 Number of Angkutan Kota (paratransit) in Several Indonesia's Provinces (BPS, 1990-2003)

Beside paratransit, several types of bus (e.g. small up to regular bus) are operated in many urban areas. It is owned and operated by public company (e.g. DAMRI) or by private institutions. Bus in Indonesia's urban areas faces many complicated problems in many aspects. The similar conditions could be found in commuter train (e.g. in Jakarta), where the weaknes in regulation and passenger management creates a crammed passenger in and on the top of train. This long-term situation expresses the high demand of passenger but the government or public transport operators are not able to fulfill it.

Fortunately, in 2002, the positive practice in developing and improving the condition of public transport in Indonesia's urban areas took place in Jakarta. In the beginning, there are pros and cons regarding this implementation (see e.g. Santosa and Basuki, 2004). But, after the successful in the 1st and 2nd corridors, there are a positive sign from the community and other stakeholders. The implementation has been expanded up to 7th corridors. While the BRT project is a good practice in public transport improvement, the revitalization of the existing public transport should be examined carefully.

In recent time, there is a trend to make a copy of the successful of BRT in Jakarta or other public transport project in other countries to be applied in another city in Indonesia. Although it might be a good option, but it should be studied carefully and confirmed with the community opinions. The provision of public transport is not just to build, but also to manage and maintain it in the future. It should be avoided that the public transport project just as a memorabilia of the government officer for a short period of time. The real case is the implementation of monorail in Jakarta. It is undoubtedly that the project will generate a positive impact, but the hurried decision to initiate the project at present creates a protracted problem (e.g. in the case of un-available financial support). It might be that the negative impacts of this protracted problem will be higher than the positive impacts, which finally gives a detriment to the community.

The weak capability and the unclear road-map of public transport development of the government (local or central) can be found in many cities. The study of BMARTS in Bandung is a clear example, where the vision is easily to be changed as the government officer is changed. At present, the discussion seems to return to initial scheme. The plan should be studied carefully, since the project faces many crucial problems (as an example see Nainggolan et al., 2005 for fare discussion).

DISCUSSION AND CONCLUSION

Private transport will be a dominated mode of transport for urban and sub-urban areas, which is in line with the economic development and the rapid growth of middle and high-level income community in urban areas, far before the economic crisis took place (Dikun, 2003). One of the reasons for this domination is the lack of appropriate public transport. However, the stagnancy in the development of urban public transport in Indonesia creates many detriments to the community and environment. It needs to develop a visionary road map of the development of urban public transport. Moreover, strong leadership and policy mainstream of government is a requirement, as suggested by Dikun (2003).

The authors suggest two important things. Firstly is to set a priority of the development. Undoubtedly, the preference to use public transit in urban areas is dominated by captive riders. In other words, the primary task is to fulfill the need of mobility of captive riders, while the several next steps are to reduce auto's users. This approach should be supported by improvement in the management of urban public transport, developing regulation and law enforcement, and developing investment scheme in developing public transit project. The authors argue that the first task is to provide an acceptable mobility for all. In the time when the mobility of the community, especially the poor, is fulfilled, the decision to reduce mobility using private transport can be initiated. In fact, at present, the trend of the local government in solving the congestion is by developing the toll road and increases the supply of road. This approach clearly not takes side to the user of public transport, which in reality they are the captive riders from the poor class. Moreover, policies that only providing road supply is only regenerate the problem in much bigger scale in the future.

Secondly, the next step is implementing TOD (transit-oriented-development). TOD is regional planning, city revitalization, suburban renewal, and walkable neighborhoods combined (Dittmar and Ohland, 2004). It is a cross-cutting approach to development that can do more than help diversity our transportation systems: it can offer a new range of development patterns for households, businesses, towns, and cities. The best practices in implementing this approach can also be found Cervero (1998) and Newman and Kenworthy (1999). In another words, this second approach is a holistic re-definition of the urban areas to make it more sustainable and livable for all.

From the discussion above, it can be concluded that the motorization will be continue to grow. It roots on the lack of acceptable provision of public transport in term of quality and quantity, but also as a result of high preference on using private transport. The challenge becomes excessive and complex, since there is no appropriate visionary road map for development of urban public transport. Thus, the authors suggest the prioritization of plan to provide an acceptable mobility for all and to start the planning of transit-oriented development.

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